DESCRIPTION

The present invention relates to the regulation of the supply of fuel gas to a domestic heating appliance by means of a control valve driven by an electric motor, modulating the flow in response to the variations in temperature, the valve being of lift valve type, with an electromagnetic safety valve.

PRIOR ART

EP-0875720-A2 and equivalent US-A-5979484 disclose a gas flow regulating valve actuated by a rotary motor in both directions, for supplying a heating appliance. The valve is adapted to supply one flow to a appliance main burner by way of a valve outlet conduit and a pilot flow to a appliance pilot burner by way of a valve pilot outlet conduit. Motor actuation is controlled by an ambient temperature sensor, moving the valve spindle linearly for the gradual opening of the main flow outlet conduit valve hole. The valve in the afore-mentioned publication further comprises a valve member coupled to the spindle, which, being actuated by a motor, moves in both directions by way of an axial flow conduit to control the flow of gas through the valve elements, and a safety valve magnetic unit pushed by the free end of the valve spindle.

DISCLOSURE OF THE INVENTION

The object of the invention is a valve for regulating the flow of gas to a domestic environment heating appliance, of the lift type actuated by a motor and with a central flow conduit in the valve body, which comprises a flame safety

valve at the valve inlet and safety means for closing the central conduit to prevent gas escaping from the valve.

The valve spindle is moved linearly by the motor in both directions by changing the direction of rotation, in the first direction to actuate the flame safety valve for its resetting, and in the second opposing direction to regulate gas flow by means of a modulating valve. The safety valve is held open by a thermocouple heated by a pilot flame in the heater appliance. In the event of motor rotation getting locked, once the safety valve has opened, the valve spindle would continue exerting pressure on the flame safety valve and stopping it from closing if the pilot flame goes out. The control valve according to the invention has safety cut-off means to prevent the flow of gas to any of the valve outlet conduits, even though the electromagnetic flame safety valve is open, until the valve spindle has moved forward away from it. The valve spindle is a one-piece stem with its forward movement controlled by a step motor, a single valve cut-off member permits the supply of a pilot flow and a main flow modulated between a minimum and a maximum flow, and said means for the safety cut-off of the flow conduit between the gas inlet and outlet are coupled to the valve spindle and are of simple construction.

DESCRIPTION OF THE DRAWINGS

FIG.1 is a sectional view of an initial embodiment of a gas regulating valve with the "closed" position with the flame safety valve in the inlet actuated.

FIG.2 is a sectional view of the embodiment of the valve of figure 1 in the "open" condition for the passage of maximum flow.

FIG.3 is a sectional view of a second embodiment of a gas regulating valve in the "closed" position, with the flame safety valve in the inlet actuated.

FIG.4 is a sectional view of the regulating valve of FIG. 3, in the "open" position for the passage of "maximum flow".

DETAILED DESCRIPTION OF THE INVENTION

In reference to FIG. 1-4, a first embodiment 1 (FIG. 1-2) and a second embodiment (FIG. 3-4) of a regulating valve according to the invention are described here, adapted for the supply of a pilot flow 2 to a pilot burner and of a main flow 3 to a main burner of a heating appliance, controlled by an ambient temperature sensor, not represented in the drawings.

Both regulating valve embodiments 1, 1' comprise a valve body 4 with an axial flow conduit 5 traversing the body 4, an inlet conduit 6 from an external gas source, an outlet conduit 7 for a pilot flow 2 and an outlet conduit 8 for a main flow 3, all oriented transversely to the flow conduit 5, and a valve spindle 10. A step motor 9 is located on the body 4 and actuates the valve spindle 10, and a magnetic safety assembly 14 is housed in the opposite end of the body 4 forming a flame safety valve 14,15. The motor 9 moves the valve spindle 10 linearly for the gradual opening of a modulating valve 11,12 which regulates the passage of the main gas flow 3 to the outlet conduit 8 from a regulating chamber 18. The main flow 3 is supplied in two

states: a "minimum" flow 3 dependent on the adjustment of the bypass screw 19 and a modulated flow 3, dependent on the travel 13 effected by the modulating valve cut-off member 11.

Following the mode of operation of the regulating valve 1,1', the valve spindle 10 is moved linearly by the motor 9 in both directions of the flow conduit 5. At the start of the regulating valve 1,1' operation , the spindle 10 moves in the opposite direction to the motor 9 and one end 10a of the valve spindle pushes the magnetic assembly 14 overcoming the resistance of its return spring (FIG.1 and FIG.3). Thus, the safety valve 14, 15 is open and the gas enters the axial conduit 5. In the direction "e" (FIG.1) of forward movement of the spindle 10 towards the motor 9, the cut-off member 11 gradually lifts off its seat 12, overcoming the resistance of a return spring 17. The cut-off member 11 is held in successive operating positions along the regulating chamber 18 formed downstream in series with the flow conduit 5. In the cut-off member 11 regulating position shown in FIG.2 and in FIG.4, the outlet conduit 8 supplies a "maximum" flow.

When initially the modulating valve 11,12 is still closed by the pressure of the return spring 17, a pilot flow 2 is supplied by the outlet conduit 7, and a "minimum" main flow 3 is supplied via a communicating hole 20 fitted with said "bypass" screw 19, which forms a bridge to the regulating chamber 18, setting the gas access from the safety valve seat 15 to the main outlet conduit 8 in direct communication. The pilot outlet conduit 7 and said communicating hole 20 start transverse from the central

conduit 5 each of them extending in a direction towards a side of the valve body 4 opposite to the other.

When the direction of motor 9 rotation changes, the spindle 10 retracts in direction "e" at the termination of a period of heating of the thermocouple which supplies the magnetic assembly 14, whereby the safety valve 14,15 may close in the event of the pilot flame going out. When the motor 9 has to change direction of rotation for the retraction of the spindle 10, motor failure may occur and the consequent locking of spindle 10 forward movement . In this case it is necessary to prevent gas escaping. The two regulating valve embodiments 1,1' are provided with cut-off means 21-24, 21'-22' respectively, housed in an intermediate portion of the flow conduit 5, between the pilot outlet conduit 7 and the direct communication hole 20 with the main outlet conduit 8.

In reference to FIG. 1-2, in an initial regulating valve embodiment 1 the flow conduit 5 cut-off means 21-24 comprise a lift valve 21,22 with a flat disc-shaped cut-off member 21 resting on a seat 22 coaxial with the spindle 10, and located upstream of the modulating valve cut-off member 11. The cut-off member 21 is drawn by a washer 23 attached to the spindle 10, overcoming the force of a return spring 24.

The safety cut-off member 21 is raised by the forward movement "e" of the spindle 10 up to two relative positions (not represented in the drawings) prior to that of modulating valve 11,12 opening. In a prior position of the spindle 10 the tip 10a of the spindle is separated from the magnetic assembly 14, but the flow of gas to the outlet

conduits 7 and 20 remains closed. In a subsequent intermediate position of the spindle 10, the safety cut-off member 21is separated from its seat 22 so as to supply pilot flow 2 and said "minimum" flow via the direct outlet conduit 20, but the regulating cut-off member 11 still remains closed on its seat 12 owing to the fact that the compression coefficient "k" of the modulating valve spring is higher than that of the spring 24 of the safety cut-off valve 21,22. As the forward movement of the spindle 10 continues, the modulating valve cut-off member 11 also effects a travel 13, so that now the main flow 3 is also supplied via the outlet conduit 8. In the embodiment represented in FIG.2 the cut-off member 11 of the modulating valve 13 has completed a maximum travel 13, drawn by the safety cut-off member 21, so as to supply a "maximum flow".

In reference to FIG. 3-4, in a second embodiment of the regulating valve, the flow conduit 5 sealing means 5a, 21',22' comprise a flat disc 21' attached to spindle 10 encircled by a sealing O-ring 22, which slides snugly in an intermediate portion 5a of the axial flow conduit 5, adjacent downstream to the safety valve 14,15. In this embodiment 1' represented in FIG. 3-4, the flow conduit 5 downstream of the regulating chamber 18 is made up of two portions 5a,5b of conduit, both of smaller diameter than the chamber. The pilot flow outlet conduit 7 and the direct outlet conduit 20 leave transversely from the portion 5b of conduit adjacent to the chamber. The sealing disc 21',22' slides in the portion 5a of conduit located upstream, and it is of smaller diameter than the portion 5b of conduit adjacent to the regulating chamber 18. In this way, in its forward movement "e", once the safety valve has opened

14,15, the spindle 10 will effect a prior movement during which the safety sealing disc 21',22' slides along the portion 5a of conduit to seal it and prevent gas escaping (FIG.3), and in this way it is ensured that the spindle 10 is not locked when the motor 9 changes its direction of rotation. When the disc 21',22' is positioned in the portion 5b of larger diameter conduit, the passage is open to the pilot outlet conduit 7 and to the "minimum flow" communication hole 20. In the position of spindle 10 represented in FIG.4 the sealing disc 21',22' is exerting pressure on the modulating valve cut-off member 11 and raising it from its seat 12, thereby supplying a maximum flow 3 along the outlet conduit 8.